A PROPOSED PROGRAM FOR HAWAIIAN FISHERIES

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Preface

This program was developed in response to a request by Mr. T. C. Yim, State Representative. Responsibility for it rests solely with the author; it is not a joint contribution of persons interested in Hawaiian fisheries and therefore reflects the viewpoint of an individual rather than of a group. However, Dr. R. W. Hiatt did see draft versions and did make a number of valuable suggestions aimed primarily at making the presentation more understandable.

The text was completed during the fall of 1964 and therefore does not reflect subsequent developments such as the substantial program concerned with brackish water fish culture now under way at the Oceanics Institute. However, these developments do not alter in any basic way the conclusions and recommendations made. The text also was circulated to a limited number of persons interested in Hawaiian fisheries for their comments. In some instances comments were received. These comments were, in general, not concerned with the conclusions reached or the programs proposed, but with patterns of emphasis in appraising existing programs.

I have not modified this text in response to these comments.

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Introduction

The Problem of the Hawaiian Fisheries

Following a postwar expansion, the fisheries of Hawaii provided employment for about 2,500 fishermen. Subsequently, the number of commercial fishermen declined until by 1960 there were less than 1,000 fishermen still so engaged. The reasons for this disastrous decline were fairly evident. During this decade two things happened: (1) cost of many things, including fishing operations, rose markedly, and (2) employment opportunities in other occupations for men with fishermen's skills appeared with increasing frequency. Moreover, concurrently with the increases in operating costs and in income from competing occupations generally, the price of fish, especially tuna, remained relatively stable. The importance of the tuna price in this connection as regards our local situation relates to the fact that the tuna landings constituted two-thirds or more of the total Hawaiian fish catch. The crisis in the Hawaiian fisheries was not unique; a similar pattern characterized many of the fisheries of the continental United States.

The factor that had stabilized the price of fish both for Hawaii and for the continental United States was the importation of fish from foreign sources. Foreign fisheries grew very rapidly following World War II, among these being the Japanese distant water tuna fishery which grew more rapidly than most, selling a large part of the catch to countries other than Japan, especially the United States. The continuing effect of imports of fish taken by foreign fishermen in stabilizing the price of fish in the American market must be recognized and its consequences appreciated. One of these consequences is that the American fisherman is not likely to solve his problem of eliminating the gap between what it costs him to fish and what he receives for the catch by the simple expedient of

raising the price of fish. It is doubtful that even if the competition, i.e., the foreign imports, were eliminated by legal means, that this would really solve the problem. Fish must compete with other protein foods, and the cost of a pound of fish to the consumer must be considered in connection with the cost of a pound of pork, of chicken, or of beef. The production of alternate and competing kinds of protein food in the United States is so much greater than the fish catch that the entire elimination of the latter could be made up through a slight growth in the production of these competing protein foods with perhaps the most noticeable loss being only that of variety in the diet.

The solution to the dilemna of our fishing industry must be found in a different direction, that of a substantial reduction in the cost of catching fish. This is a most difficult thing to do; if it were easy, certainly the fishemen would have done it. More efficient fishing techniques, if devised, can be employed to full advantage for harvesting stocks of fish which are incompletely harvested at present by the use of existing fishing techniques. Their employment for harvesting fully utilized fish stocks may also necessitate some regulation of fishing effort, but not of fishing gear if economic benefit is to result. Another significant point to bear in mind is that it is quite likely that the development of a new fishing technique sufficiently efficient to permit a substantial growth in Hawaiian fisheries will also make all or most of the existing Hawaiian fishing fleet obsolete. The possibilities of substantially increasing the fish catch using the present vessels and some modification of the present methodology of fishing is remote. If some patching up of existing methods and equipment would solve these problems, the possibilities are good that the solutions would be in hand by this time.

While the number of commercial fishermen has steadily declined since 1950, the commercial fish catch has remained relatively stable, suggesting that some major increases in fishing efficiency have occurred. The production of individual

fishing units within a given fishing fleet, when examined, also suggests that some of the general statements concerning the situation of the Hawaiian fisheries do not hold for all fishing units. Some captains and crews of fishing vessels continue to catch enough to provide satisfactory levels of income. This income is earned with vessels of prewar vintage or with vessels constructed during the few years of fishing prosperity immediately following World War II; other than small fishing vessels and skiffs there have been few, if any, built during the last decade for use by the Hawaiian commercial fisheries. The lack of new construction, even for replacement of craft worn out or sunk, suggests that the better levels of fish catch and fisherman income are insufficient if the costs of amortizing new construction be considered. The lack of such construction suggests further that Hawaiian fisheries cannot grow and will inevitably decline if the situation remains unchanged.

Programs of research and development, both governmental and private, for Hawaiian fisheries have in general been ineffective if the growth of these fisheries is in any sense a measure of effectiveness. Some of the best work in oceanic fisheries and fisheries oceanography has been done in Hawaii. The scientific programs concerned with fisheries are among the most advanced carried on anywhere, yet these programs did not stimulate the growth of the fisheries nor did they arrest in any measurable way their decline.

Since the end of World War II, possibly between $10,000,000 to $15,000,000 has been spent on protection, administration, research and development of the fisheries of the Central Pacific and Hawaii. This is a large sum of money, and if a major objective of those who authorize this expenditure was the growth of the fishing industry in this area, a critical examination of the situation would seem appropriate. Some of the factors involved relate to the slowness with which good research is accomplished and the rapidity in which supply and demand of fish changed as a consequence of the rapid postwar expansion of some foreign fisheries,

especially the Japanese. Traditionally, the program was primarily one of fishery research with only minor efforts being devoted towards working closely with the commercial fishing industry to directly stimulate the growth of that industry. Perhaps for ideological reasons, close and effective working relationships between the government and the fishing industry appear difficult to achieve in this country. The Japanese, whose fisheries have expanded so rapidly and so well, seem to have quite effective working relationships in this area. Finally, it is not unlikely that at least $15,000,000 or even $20,000,000 or more of expertly conducted fishery environmental research is a necessary prerequisite to any large scale developmental programs designed to provide fishing techniques with greatly increased efficiency of capture.

Another aspect which must be considered in developing a major Hawaiian fishing industry is that of markets. A major fishery must have a major market for its catch. In Hawaii this implies a processed or frozen product for export. The local demand will not sustain a major fishery. The per capita consumption of fish in the United States is about 12 pounds a year. On the basis of 650,000 average consumers of sea food in Hawaii, this would require about 3,900 tons of fish. The local aku fishery takes substantially more than this, approaching twice as much per year. If the inhabitants of the Hawaiian Islands were enthusiastic consumers of sea food, eating about a pound a week, 52 pounds a year or four and a third times the national average, less than 16,000 tons of fish would be required, not allowing for waste. Even this high demand would do no more than require a healthy doubling of the present local production of fish. Hence, while the local demand for fish is important and should be taken care of as far as possible from local sources, it must play a supplementary role in the development of a large Hawaiian fishing industry.

The Nature of the Hawaiian Fishery Resources

The islands of the Hawaiian archipelago rise abruptly from the deep ocean and are surrounded by relatively minor amounts of shoal water. Around the islands and over the shoal areas occur a variety of fishes which require the existence of reef and shoal areas for their survival. These inshore shallow water species make up, collectively, one segment of the Hawaiian fishery resource. The oceanic fishes, the species inhabiting the high seas with no requirement for shoal or inshore areas for their survival, make up the other segment. The magnitude of these two segments is related to the magnitude of their respective habitats. Although the unit density of fish in reef and inshore waters is much greater than that in the open sea, the area of the former is so limited that the resource of oceanic fishes is by far the most important and valuable one. Problems relating to the conservation and development of these two segments of our fishery resources are quite different, so different, in fact, that they must be considered separately.

The Oceanic Fishes

The fishes of the open ocean include a number of species of sharks, the mahi-mahi, several species of marlins, flying fish, and most importantly, the tunas. Of the tunas the most abundant is probably the aku (skipjack or oceanic bonito). Yellowfin and bigeye tuna are both important species in the Central Pacific; however, it would be difficult to demonstrate which of the two is the most abundant. Problems of fishing gear selectivity would make the use of the commercial catch for this purpose of dubious value. Albacore tuna is also present, occurring about the thermocline or deeper in the tropical waters of this region. The major albacore fisheries are in temperate latitudes, aside for the South Pacific longline fishery based primarily in American Samoa.

Presently there are a number of methods used for the capture of oceanic species of fish. In the Mediterranean and the coast of Japan large fixed traps

are used in certain areas. In the Eastern Pacific, in temperate waters in the Atlantic of the United States, of Japan and of Norway, purse seine nets are used. In the Central Pacific two fishing methods, the live-bait method and the longline method, are employed, and these methods are also employed in oceanic fisheries in other areas.

The live-bait method involves the use of small living fish for chumming or attracting a school of fish, usually tuna, close to the boat where once they are in a feeding frenzy, large numbers can be rapidly hooked by fishermen equipped with a pole and line with a barbless hook attached. The largest fishery in the Hawaiian Islands, the aku fishery, is based on the use of this method, yielding between 5,000 to 7,000 tons per year. To be effective the live-bait method requires 1) an abundant source of baitfish, and 2) the presence of schooling oceanic fish at the surface of the sea.

In Hawaii there appeared to be two major limitations to the expansion of this fishery. The first and most important lies in the shortage of baitfishes. Suitable baitfish are in such short supply that the young of an African fish that will survive in sea water, Tilapia, have been reared in large numbers in a state-operated baitfish hatchery in a pilot effort to learn whether this method of supplementing the bait source is practicable. The other limitation is the relatively short season during which aku are abundant in Hawaiian waters. That season lasts roughly from May to September, with the period of maximum abundance being the three summer months, June, July and August. At other times of the year the local abundance of skipjack is not sufficient to sustain a major commercial fishery. This suggests the desirability of locating areas where these fish are abundant at other seasons of the year and developing methods for taking them or developing alternate fisheries for the employment of this fishing fleet.

The other important method for taking oceanic fishes in the Central Pacific is the longline gear. This consists of a line to which baited hooks and floats

are attached at intervals to a long line set under the surface of the sea. A set of gear may have hooks at about 30-fathom intervals in units of 4 or 6, each unit being called a basket, and from 20 to 400 baskets may be set, depending upon the size of the fishing boat and the number in the crew. The high number of baskets would be characteristic of a large longline vessel from Japan. The catch is usually computed in numbers of fish taken per 100 hooks set, and it usually is less than half a dozen fish per 100 hooks, averaging possibly about three in the Hawaiian area. The longline gear is the principal gear used by the distant water Japanese tuna fleet which fishes in the Pacific, Indian and Atlantic Oceans. A large part of the world catch of tuna is taken by longline gear. It appears to be a most efficient gear for taking fish that are either scattered or occur in small schools. The wide spacing of hooks, and in terms of the number of fish in a school, the relatively small number of hooks suggest that it would be an inefficient gear for schooling fish. Possibly related to these characteristics is that it appears to fish in a selective fashion, for the catch obtained is dominated by large fish.

The local longline fishery based in Hawaii takes bigeye and yellowfin tuna and marlins for the fresh fish market; the landings are a few million pounds per year. However, the wide ranging Japanese longline fleet operating in the Central Pacific takes perhaps 60,000 to 70,000 tons of fish a year within a 1500-mile radius of Honolulu.

The dominance of the larger tuna in the landings taken by longline gear together with the magnitude of the catch taken by the Japanese in the Central Pacific area suggests that a major tuna resource may be available in this area and that the larger part of it is not being harvested by the Japanese. The reasoning behind this inference is as follows:

1. For any population of animals that is either stable or growing in numbers, the youngest are the most numerous; with increasing age the number of individuals

decreases with the oldest individuals being the least in number.

2. While with increasing age the number of individuals decreases, the growth rate of these individuals may compensate for the loss in number so that for a time the population as a whole increases in weight. This effect depends on the growth rate of the individuals of the population being for some great enough to exceed the loss of those who die or are eaten.

3. With increasing age and maturity the growth rate slows so that the growth of individuals in the population does not exceed the loss in weight by death or predation of others of the same age. There is an age where the increasing weight by growth of individuals is just equal to the loss in weight through the death of others of that age. For a fishery to reserve the harvesting of fish beyond this age is simply to have less weight of fish to harvest.

4. It is obvious that the particular age or size for which the sum of the weight of individuals is greatest depends on how fast they grow and how rapidly they are dying. Tuna appear to grow rapidly and to live for only a few years, 3 or 4 years for aku or skipjack, and 5 or 6 years for ahi or yellowfin.

The accuracy of the estimate of the age at which the weight of an age group is greatest depends upon the accuracy with which rates of growth and mortality can be estimated. The data for growth are perhaps adequate for rough estimates while those for mortality are not.

As mentioned, the longline fishing gear takes a very high proportion of large and old fish. The failure of the gear to be effective for smaller fish is puzzling. I suggested several years ago that this may be an effect of schooling, the gear being inefficient for schooled fish. Unless the mortality rates for yellowfin and bigeye tuna are very low for the smaller sizes, the catch of tuna taken by longline gear in the Central Pacific may be only a fraction, possibly between a third and a fourth or less of the potential catch of these species in this region. Regardless of the technicalities advanced in the argument above,

this is the important point. There may be a far larger weight of fish in the Central Pacific not now being taken effectively by the type of gear employed. An estimate that presently used gear now takes between 60,000 to 70,000 tons per year was made earlier.

The catch of this magnitude can be considered as providing the basis for a major fishery, and the possibility may exist that a potential catch of several times this magnitude can be taken. However, the validity of the inference is no greater than the validity of the growth and mortality rates upon which it is based. If the inference is valid, where are the more abundant stocks of younger fish? Are they in the Central Pacific? And if they exist and can be located, how do we fish them economically?

The very large tuna fishery in the Eastern Pacific is based on smaller fish, and offhand one might be tempted to assume that the Eastern Pacific fishing grounds are where the adolescent fish gather for a time by reason of the food resources. The larger and older fish may later retreat to the clear waters of the open ocean away from the coastal environment. Studies made of tuna stocks and their ranges suggest certainly for yellowfin tuna that those in the Eastern Pacific are independent of those in the Central Pacific. The smaller sizes of bigeye tuna appear to be abundant nowhere, certainly not in the Eastern Pacific; the relation of stocks of this species in the Central and Eastern Pacific is not known. Aku or skipjack tagged in the Eastern Pacific have been recovered both about the Hawaiian Islands and in the equatorial region directly south from Hawaii, which suggests for this species a common stock in both regions in contrast to the situation for the yellowfin.

The aku which is not taken by longline and for which the larger sizes are the more valuable for canning is a reverse of the situation for the large yellowfin and bigeye; the larger aku that occur seasonally in Hawaii are a specially desirable catch. If the unavailability to longline gear of the smaller sizes of

yellowfin and bigeye and for aku generally is related to the schooling habit of these fish, then the possibility occurs that some other fishing gear effective for the schooling members of yellowfin and bigeye would also be effective for the aku, which is likely the most abundant species of all. This ideal gear may be required to be effective well below the surface of the sea. If there are schools of small yellowfin and bigeye tuna in this region, they are not noticeably abundant at the surface of the sea, especially the latter species.

In summary, the operations of the Japanese longline fleet in the Central Pacific have demonstrated the existence of a major tuna resource. The large size of many of the fish taken suggests that the gear is primarily effective for the older and less abundant tuna in the population. These fish likely represent but a fraction of the total tuna stock. The younger and more valuable fish for canning purposes, at least, may not be in the same region where the larger fish are taken, but are not apparently in regions where small fish are taken in abundance by existing fisheries. This in turn suggests the possibility of developing a major tuna fishery or fleet based in Hawaii by locating the medium-sized or smaller fish of the same stocks for which the Japanese take the older individuals, and developing fishing gear effective for these fish which likely represent the bulk of the population. These are difficult problems to solve. A solution should probably be attempted in the following order:

1. The accumulation of data on the growth and mortality rates of the various species of tuna for the Central Pacific. The analysis of these data will permit confirmation of the inference developed above which has been based on rather inadequate data.

2. If it appears that major stocks of medium-sized tunas must exist, apparatus for their detection, such as powerful sonic fish finders, should be employed in a careful coordinated search. If substantial stocks of medium-sized tunas are located, experimental gear should be designed for their efficient capture and

tested in the field. The design of this gear should wait upon information developed by the use of the fish finder mentioned above; such information should include the areas of abundance, the size and behavior of the schools of fish and the nature of their occurrence, i.e., are they near the surface or do they run deep.

In addition, steps should be taken to preserve at least a nucleus of the existing Hawaiian fisheries which will provide a pool of trained fishermen and a Hawaiian processing facility to handle the fish. Government support for the construction of a prototype long-range Central Pacific fishing vessel might be a way of initiating this program. Such a vessel should be equipped to employ the existing fishing techniques, such as live-bait fishing and longlining, and, in addition, should be so designed that her radical conversion for new and unforeseen fishing techniques would be possible.

Minor Fishery Resources

While the inshore and bottom fishery resources are of modest potential and therefore do not afford the basis for a major Hawaiian fishing industry, problems relating to these resources are of interest to many persons in Hawaii. For some of the species involved, an increasing portion of the catchable stock seems to be taken by recreational fishermen with their commercial exploitation diminishing. A study of the commercial catch statistics may suggest that the availability of these fishes is becoming less; unless the recreational catch can be also included, this suggestion is difficult to verify.

If the diminution in commercial yield from the fishery resources concerned is a response to an increased recreational yield, with the total yield not changing significantly, the problem involved is not a biological one, but a socio-economic one. It may be true that a recreational use of these fishery resources is a pattern of use desired by more people than the commercial use, but this is an issue to be settled by society, not by the fishery biologist. Economic

studies of the value of these resources in terms of various patterns of use, recreational, commercial or combinations of these, should be made as a basis for guidance in the determination of public policy in regard to management where conflicts in use arise, and in the selection of use patterns to be promoted. However, the degree of use should be managed, whatever its character, to approximate the sustainable yield of the resource.

The management problems, and the problems of fishery biology are often as difficult of solution for a small fishery as for a large one. The magnitude of the effort available for solving these problems must bear a reasonable relationship to the value of the harvests from the resources with some consideration of their potential magnitude as well. Where these are modest, a modest conservation effort is in order. If the conservation effort must be of limited magnitude, a rapid solution of the problems involved must not be anticipated. There is some level of fishery research effort below which nothing very useful is accomplished, and in this regard it may be worthwhile for the agency responsible for the management of these minor inshore fisheries (1) to maintain a routine data collecting program for many of them and (2) to place efforts at the analytical research level on one or a few of these fisheries at a time.

To determine the annual investment to be made for the conservation of these fisheries, estimates must be made of their probable worth. These will require studies of the economics of these fisheries and the use of crude and imperfect appraisals of the population dynamics of the species concerned to provide some order of magnitude figure of the potential yields. The recreational fisheries must also be included with the commercial fisheries in such studies. The estimate of the level of state expenditures for the conservation of the inshore fishery resources should be periodically reviewed; as these resources increase in value, a greater conservation effort if justified. The budgeting of the state expenditures for the conservation of the inshore fishery resources should include

the following items:

1. Collection, compilation, and periodic publication of the yields from these fisheries, the value of the yields, the fishing effort involved, and the effects of fishing on the stocks of fish. The licensing of fishermen and the requirement of catch reports are most important sources of information. For some aspects of these tasks, fishermen interviews, sampling of the catch and research concerned with the condition of the fish stocks will be required. Field methods of estimating the magnitude of fish stocks, and changes in them should be developed and refined.

2. The enforcement of laws respecting the fisheries. The effective enforcement of conservation laws is expensive. Therefore, the enactment of such laws should be based on a demonstrated requirement and the body of conservation law should be periodically reviewed and obsolete ones repealed. The body of conservation law should reflect the current knowledge of the resources concerned.

3. The administrative costs of the state agency responsible for the conservation of the inshore fishery resources.

4. Support of programs concerned with the improvement of the inshore fishery resources. To a major degree, the role of the state has been to provide matching money for the Federal aid to fish restoration grants. The programs thus financed include some research, habitat improvements, introductions of new species of fish, and other analogous activities.

5. Support of some fundamental investigations of the mechanics of the productivity of tropical inshore fisheries. Unless considerable additional knowledge be had of those factors that affect the levels of abundance of the fish stocks concerned, efforts to increase yields by various improvements or by conservation laws are likely to be rather inefficient. In the long view, work in this field holds the greatest promise for achieving major improvements in the productivity of fisheries. In my opinion, the level of competency required for such investi-

gations suggests that they be handled by the University.

Other Possible Fishery Resources

There remains some additional possibilities for the development of fishery resources. One possibility lies in the rearing of confined marine organisms for profit. The best opportunities are probably the use of oysters, clams, and shrimp. Certain fishes may provide possibilities for profit. The use of some of the existing mullet ponds owned by the State for experimental purposes could possibly provide facilities for an investigational program at little cost. A modest program concerned with the cultivation of marine organisms for profit should be funded. Since it would be primarily a matter of research, it should be the responsibility of a research agency to accomplish. Some interest in this type of research has been shown by a private agency.

Possibilities may arise through research for the profitable use of public waters for aquaculture. A technique successfully used in Japan, Taiwan, and elsewhere, for example, for the cultivation of oysters is to suspend them from rafts in bays or other protected bodies of water. On the eastern seaboard of the United States, shoal water areas are leased to private operators for oyster culture by several of the states. It is presently doubtful that the examples mentioned above would be profitable under Hawaiian conditions, but certainly in principle, an effective aquaculture should outproduce fishing, area for area, by an order of magnitude, for the first is based on agricultural principles, and the second, on those of hunting. If methods of aquaculture suitable for Hawaiian conditions are developed which require the use of open state waters, a legal means whereby this could be fairly and equably done may become important and necessary.

The existence of other fishery resources not yet used is a possibility. There may be some midwater or demersal shrimp resources in deep water of species of a high intrinsic value but of modest abundance. Other species of oceanic fishes, especially those of the mid-depths well below the thermocline, may be of

sufficient abundance to constitute a valuable resource.

What Needs to Be Done

By the Federal Government:

The Bureau of Commercial Fisheries Biological Laboratory should take the primary responsibility for the development of the exploitation of the oceanic fishes. This is presently the case. There are two major tasks: (1) the location of the schooling tunas which probably involves the development and use of new sonic fish finding equipment, and (2) the development of effective techniques for the harvest of such tuna, once they are found.

The program of the development of a suitable fish finder is, I believe, in progress. Funding is being sought for a program concerned with the development of new fishing techniques; the American Fisheries Advisory Committee recommended an annual increase in funding for the Honolulu Biological Laboratory of half a million dollars for this purpose.

The Federal Government has established programs of assistance to fishermen in the form of loans for the modification of existing vessels or the construction of new ones. Should a new gear design be developed effective for the capture of the schooling tunas which requires new vessels for its efficient use, the Federal loan program may be an important source for the financing of such new construction.

By the State Government:

1. A study of the economics of the Hawaiian fishing industries, including the aspects of production, distribution, sale, and processing. Also the economic relation of recreational and commercial fishing should be studied.

2. The catch of fish and fishing effort expended by recreational and commercial fishermen must be recorded through fish catch reports, fishermen interviews, or surveys in the detail required to permit useful estimates of the maximum sustainable yields for Hawaiian fishery resources and the role of recreational and

commercial fishermen in their use. Presently used reports of fish catch and records of fishing effort should be critically reappraised for their adequacy for these purposes.

3. Field methods for the estimation of the magnitudes of fish stocks and changes in them need to be developed and refined as supplements to the fish catch report data and as an independent check on the results of their analyses.

4. The results from 1, 2 and 3 should provide a guide for both the legislative and executive branches of the State Government in formulating budgets for state-supported activities and agencies concerned with the inshore fishery resources.

5. The State should fund some research, possibly at the University, concerned with the basic mechanisms of marine productivity as these relate to the yields, realized or potential, from inshore fishery resources. This should be done as a long-term investment in their rehabilitation and scientific management.

6. The State should be prepared to support some aspects of work relating to oceanic fisheries where local participation in the work seems called for and is justified. The collection, compilation and publication of catch statistics of the oceanic fisheries as a routine function is an example. Joint projects with Federal agencies where by such participation some advantages accrue to the local fishing industry is another.

Both State and Federal agencies concerned with fisheries and fishery resources should remain alert to the possibility of new resources becoming evident during field programs, and should suggest exploratory programs to estimate the magnitude of such new resources if evidence of them is found.

Resumé

The commercial fisheries of Hawaii are, for almost all elements, either stagnating or declining. For some of the inshore fisheries which are based on stocks of limited size, the yield which they are capable of sustaining may already be exceeded. For the oceanic fisheries the stocks appear to be capable of sustaining much greater yields. However, costs of fishing have grown more rapidly than the value of the catch. The use of some of these fisheries primarily for recreational purposes may provide the maximum sustained income from them. Because of the great differences in the magnitude of the resources concerned, the problems of the Hawaiian fisheries can best be considered in two parts: first, the inshore and demersal or bottom fisheries, and second, the oceanic or high seas fisheries.

The inshore and demersal fishery resources, being primarily in state waters or closely adjacent to such waters, would seem to be principally a responsibility of the state. Programs designed for the rejuvenation of these fisheries for their fuller development should bear a reasonable relation to their present and potential value. The nature and extent of such programs should be based on 1) an economic analysis of both the fishing industries and resources concerned, considering both commercial and recreational uses, and 2) estimates of the magnitude of the fishery resources based on such information now available from fish catch records and related sources. The routine accumulation of such information specifically designed to permit further refinement of these estimates is essential.

Oceanic fishery resources are found in the open oceans and are not affected except indirectly by the presence or absence of land. The harvest of these resources may be pursued at great distances from port in international waters where the catch is shared with fishermen of other nations. The catch taken by these foreign fishermen also competes with that taken by our own fishermen in

the United States market. As far as governmental actions may affect this competition, the Federal Government, rather than the State Government, is primarily involved. For these reasons it would seem that the Federal Government should bear the primary responsibility for the rehabilitation and development of oceanic fisheries. Required here are efforts in two program areas. (1) It is essential that the fishing techniques be improved to the point where the fisheries for oceanic species can profitably compete with their foreign competitors, and for the manpower required to man the fishing fleets can profitably compete with other domestic occupations. The development of such improved fishing techniques will require both time and dedicated effort. (2) Required, therefore, are interim programs of support of various sorts that will keep our hand in on at least a nucleus of the existing international oceanic fishing fleets to serve as a base on which to build a new industry when the development of new fishing techniques will permit it. There is evidence that the existing techniques for catching tuna result in a harvest of only a part of the potentially available catch in much of the tuna-producing waters of the world.